United States Department of Agriculture
Agricultural Research Service
Southern Region
Oklahoma-Texas Area
Screwworm Research •
Apartado Postal #544
Tuxtla Gutierrez, Chiapas
Mexico

November 1, 1983

SUBJECT: Laboratory Development of the Villa Flores (VF-84) Strain

TO: R. E. Reichard, Co-Director
Comisión México-Americana para la Erradicación
del Gusano Barrenador del Ganado
Leibnitz No. 20-12o. Piso
Apartado Postal M-2890
06000 Mexico, D. F.

At the technical meeting in Oaxaca I reported that the Tabasco strain after three generations in our laboratory had expressed characteristics not conducive to mass production and that we had concluded that no further attempts should be made to develop it into a strain for use in the eradication program. At that time Drs. David Taylor and R.L. Mangan had already begun to collect egg masses from the area around Villa Flores, Chiapas so that a replacement strain could be developed.

So far their effort has proceeded beautifully. Dr. Taylor and his associates collected 98 egg masses in 12 days, of which 61 were collected in a 3-day period. The number has now been narrowed down to 66 lines whose mean larval weight is 70.6 mg and whose mean yield is 15.6 ml of pupae. In the 66 lines there are 29 with larval weights 70-79 mg and 5 with larval weights greater than 80 mg. Larval and pupal development times and adult eclosion have also been excellent. To date there have not been any pupal malformations or undue mortality in any stage of development.

The weaker isofemale lines are being discarded but there will apparently be 30 to 50 strong lines from which to select for the crosses from which the new strain will be established.

Most of the lines are in the laboratory as $F_1$ adults this week. In the strain development process rigid schedules are counter productive but it appears that crosses should be completed before the end of February and that, if ARS provides pupae of the Villa Flores strain to Methods on 21 consecutive days as was done with Oaxaca strain, the transfer of the new strain could begin about April 1.

O H Graham

O. H. GRAHAM
Location/Project Leader

cc:
R. A. Bram
C. J. Whitten
R. E. Lowe
J. D. Hoffman
D. B. Taylor

RECEIVED NOV 2 5 1983 O. H. Graham

HEALTH-CHEM CORPORATION

1107 BROADWAY • NEW YORK, NEW YORK 10010 • TELEPHONE (212) 691-7550

HERCON DIVISION TELEX NO. 4992962 HCHEM

November 11, 1983

Dr. Harold E. Brown
USDA-ARS
P.O. Box 267
Weslaco, Texas 78596

Ref: W/231/arq

Dear Harold:

Enclosed are the receiving reports on the remaining swormlure chemicals that were shipped by Para Scientific Co. Please make sure that the quantities that were delivered were those you ordered. Incidentally, the containers marked in the Bill of Lading as methyl disulfide were actually dimethyl disulfide.

Also enclosed is our report of our pre-production meeting. Listed are the different products that we can make. Please review and if you have any preferences, please rank the various formulations according to importance. If there are other combinations of active ingredients that you wish us to prepare, please let me know.

Our York plant will start making the samples as soon as we have an idea of which products you would like us to do first.

Sincerely,

Bert

Alberto R. Quisumbing, Ph.D.
Director, Product Development

ARQ/tt
Encls:

cc: M. Beroza
D. Kauffman

see ATTRACTANTS RESEARCH for complete correspondence

Hugh

United States Department of Agriculture

Agricultural Research Service

Southern Region
Oklahoma-Texas Area

Screwworm Research
Apartado Postal #544
Tuxtla Gutierrez, Chiapas
Mexico

November 11, 1983

Dr. H. C. Hofmann
Comision Mexico-Americana para la Erradicacion
del Gusano Barrenador del Ganado
Leibnitz No. 20-12o. Piso
Apartado Postal M-2890
06000 Mexico, D. F.

Dear Chris,

Here is a report on ARS SWASS studies below the 21st parallel in Michoacan this past spring and summer. Some data on exposure of SWASS pellets (losses/breakdown of swormlure and vapona) are not included because analyses are not yet complete. These results will be forwarded as soon as possible. I regret that we were not able to translate this report into Spanish, but you are free to do so in your office if you feel there is the need. Please let me know if you or anyone in the Comision would like to discuss this report or have any questions.

Sincerely,

Jim

JAMES W. MACKLEY
Research Entomologist

Incl.

cc:
Moises Vargas Teran, Sub-Director of Field Operations.
Arturo Martinez y Tapia, Chief of Methods Development.
J. D. Hoffman, Chief of Methods Development.
Charles MacVean, Assistant Entomologist.
R. J. Brenner, Research Entomologist.
R. D. Peterson, Research Entomologist.
Rene Garcia, Assistant Entomologist.
Lisandro Gonzalez, Supervisory Technician.
Nazario Pineda, Director of Comision Mexico-Americana.
R. E. Reichard, Co-Director of Comision Mexico-Americana.
O. H. Graham, Project Leader.
H. E. Brown, Research Leader.

see file ATTRACTANTS - RESEARCH 1983 for complete set of enclosures

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Attachment B

# RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS

Working Group (WG): Screwworm

Staff: International Operations & Screwworm Staff FY 1986

Suggested VS Members:

Chairperson *F. E. Smith

Member W. H. Sudlow

Member H. C. Hofmann

Member J. E. Novy

Suggested ARS Members:

Chairperson * R. A. Bram

Member O. H. Graham

Member C. J. Whitten

Member

| (1) Research Needs | (2) WG Need Rank | (3) Research Project (*= ongoing projects) | (4) Date: B/E B=Beginning E=Ending | (5) Location | (6) How Funded | (7) Est. Annual Cost | (8) WG Project Rank |
|---|---|---|---|---|---|---|---|
| New factory strain development | | *Development of factory strains at Tuxtla Gutierrez | Yearly | Tuxtla Gutierrez | ARS | 200,000 | 1 |
| Better understanding of the ecology and population dynamics and population Genetics in Mexico, C.A., and the Caribbean | | Study of the ecology and population dynamics and population genetics in Mexico, C.A., and the Caribbean | B - 1980 E - Open | Tuxtla Gutierrez | ARS | 400,000 | 2 |
| Identification and characterization of Environmental and Genetic Factors which contribute to strain deterior etc. | | Discover techniques which indicate competative status of screwworm strains and can be used to predict the rate of deteriation | B - 1984 E - open | Tuxtla | ARS | 200,000 | 3 |
| *Improvement in rearing consistantly high quality screwworms | | *Develop improved rearing techniques to produce a higher and more consistent larval weight including nutrition, mechanical handling and feeding systems | B - 1985 E - 1986 | Tuxtla Gutierrez | ARS | 200,000 | 4 |

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Attachment 2

## Research Projects for Rural Veterinary Services Program

Working Group (WG): Secretary

Nominated by Inventor:

Chairperson: *F. B. Smith

Member: H. W. Stolzer

Member: H. G. Sutcrom

Member: L. E. Hoop

Staff: International Operations & Extension Staff: FY 19

Suggested ARS Members:

Chairperson: * E. A. Sirk

Member: G. H. Graham

Member: G. I. Whitten

Member:

| (1) Research Needs | (2) WG Lead Team | (3) Research Project (or program area) | (4) Date: M/E 3=Beginning 2=Ongoing 1=Ending | (5) Location | (6) Now Funded | (7) Est. Ann. Fund Req. |
|---|---|---|---|---|---|---|
| Dry Laboratory trials evaluations | | *Development of factory aerosol at Tunkia Laboratories | Yearly | Tunkia Laboratories | ARS | 200,000 |
| Basic Understanding of the ecology and pathogenesis, and vaccination immunity (Tunkia, C.A., and the Caribbean) | | Study of the ecology and pathogenesis and population genetics in Tunkia, C.A., and the Caribbean | 3 - 1990<br>5 - Open | Tunkia Laboratories | ARS | 100,000 |
| Identification and characterization of Epizootemyelitis and other tissue-active agents which contribute to brain damage etc. | | Discover isolations which induce computative agents of pathogens disease and can be used to predict the rate of detection | 3 - 1994<br>5 - open | Tunkia | ARS | 200,000 |
| *Improvement in testing and high quality vaccines | | *Develop improved testing methods or produce high quality | 3 - 1995<br>5 - 1995 | Tunkia Laboratories | ARS | 200,000 |

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm Fiscal Year: 86

| (1) Research Needs | (2) WG Need Rank | (3) Research Project (*= ongoing projects) | (4) Date: B/E B=Beginning E=Ending | (5) Location | (6) How Funded | (7) Est. Annual Cost | (8) WG Project Rank |
|---|---|---|---|---|---|---|---|
| New improved formulation and methods of Applications of SWASS for use within the barrier and for emergency treatment | | Test new SWASS formulations and methods of application for effectiveness in selected areas of the barrier and the area in front of the barrier | B - 1984<br>E - Open | Tuxtla Gutierrez | ARS | 300,000 | 5 |
| Understanding of Fundamental Genetics of Screwworm | | Apply modern Genetic techniques to screwworm population characterization | 1984<br>Open | Fargo | ARS | 150,000 | 6 |
| Develop new more effective attractants for mating assembly and oviposition | | Study Effectiveness of Attractants<br>*Trials of the following attractants: | | | | | 7 |
| | | - Wound Attractants | B - 1980<br>E - Open | Fargo, ND | ARS | 144,000 | = |
| | | | | Tuxtla, Gutierrez | ARS | 10,000 | = |
| | | | | Berkeley, CA | ARS | 5,000 | = |
| | | - Dried Blood Attractants | B - 1981<br>E - 1985 | Fargo, ND | ARS | 50,000 | = |
| | | | | Tuxtla, Gutierrez | ARS | 25,000 | = |
| | | | | Berkeley, CA | ARS | 5,000 | = |
| | | - Flower Attractants | B - 1981<br>E - Open | Fargo, ND | ARS | 36,000 | = |
| | | | | Tuxtla, Gutierrez | ARS | 25,000 | = |
| | | | | Berkeley, CA | ARS | 15,000 | = |
| | | - Calf Navel Cord Attractants | B - June 82<br>E - Open | Weslaco, TX | ARS | 15,000 | = |
| | | | | Fargo, ND | ARS | 5,000 | = |
| | | | | Tuxtla, Gutierrez | ARS | 5,000 | = |
| | | * Oviposition Stimulants | B - 1982<br>E - Open | Tuxtla, Gutierrez | ARS | 60,000 | = |
| | | | | Fargo, ND | ARS | 10,000 | = |
| | | *Trap Improvements | B - FY 83<br>E - FY 85 | Tuxtla, Gutierrez | ARS | 100,000 | = |

Attachment B

## RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS

Working Group (WG): Screwworm

Staff: International Operations & Screwworm Staff FY 1987

Suggested VS Members:

Chairperson *F. E. Smith

Member W. H. Sudlow

Member H. C. Hofmann

Member J. E. Novy

Suggested ARS Members:

Chairperson * R. A. Bram

Member O. H. Graham

Member C. J. Whitten

Member

| (1) Research Needs | (2) WG Need Rank | (3) Research Project (*= ongoing projects) | (4) Date: B/E B=Beginning E=Ending | (5) Location | (6) How Funded | (7) Est. Annual Cost | (8) WG Project Rank |
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| Better understanding of the ecology and population dynamics and population Genetics in Mexico, C.A., and the Caribbean | | Study of the ecology and population dynamics and population genetics in Mexico, C.A., and the Caribbean | B - 1980 E - Open | Tuxtla Gutierrez | ARS | 400,000 | 2 |
| Identification and characterization of Environmental and Genetic Factors which contribute to strain deterior etc. | | Discover techniques which indicate competative status of screwworm strains and can be used to predict the rate of deteriation | B - 1984 E - open | Tuxtla | ARS | 200,000 | 3 |
| *Improvement in rearing consistantly high quality screwworms | | *Develop improved rearing techniques to produce a higher and more consistent larval weight including nutrition, mechanical handling and feeding systems | B - 1985 E - 1986 | Tuxtla Gutierrez | ARS | 200,000 | 4 |

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm Fiscal Year: 87

| (1) Research Needs | (2) WG Need Rank | (3) Research Project (*= ongoing projects) | (4) Date: B/E B=Beginning E=Ending | (5) Location | (6) How Funded | (7) Est. Annual Cost | (8) WG Project Rank |
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| | | | | Berkeley, CA | ARS | 5,000 | = |
| | | - Dried Blood Attractants | B - 1981<br>E - 1985 | Fargo, ND | ARS | 50,000 | = |
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| | | *Trap Improvements | B - FY 83<br>E - FY 85 | Tuxtla, Gutierrez | ARS | 100,000 | = |

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm Fiscal Year: 88

| (1) Research Needs | (2) WG Need Rank | (3) Research Project (*= ongoing projects) | (4) Date: B/E B=Beginning E=Ending | (5) Location | (6) How Funded | (7) Est. Annual Cost | (8) WG Project Rank |
|---|---|---|---|---|---|---|---|
| Review and study of more effective systemic and conventional insecticides for use in conjunction with quarantine stations | | Test more insecticides for use as sprays, injectibles, and dipping at quarantine stations | B - 1983<br>E - Open | Tuxtla<br>Gutierrez | ARS<br>ARS | 100,000 | 6 |
| By the year 1988 the barrier zone should have been fully operative 2 years or more. Interest has already been expressed by IICA and the ministers of Agriculture to continue eradication through Central Amercia and the Caribbean. Thus, research for the barrier program should be focused primarily to improve quarantine procedures and improving sterile insect quality continuing strain development and other research projects, to insure that no fertile insects enter the barrier and that if they do their progeny are eliminated by the sterile male technique. Research to support future initiatives in Central America must continue in strain development, ecology and population dynamics, genetic population characterization, new rearing technologies, and chemical control technologies. | | | | | | | |

Rec'd Nov. 1983

Attachment B

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Member J. E. Novy

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| *Improvement in rearing consistantly high quality screwworms | | *Develop improved rearing techniques to produce a higher and more consistent larval weight including nutrition, mechanical handling and feeding systems | B - 1985 E - 1986 | Tuxtla Gutierrez | ARS | 200,000 | 4 |

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm Fiscal Year: 86

| (1) Research Needs | (2) WG Need Rank | (3) Research Project (*= ongoing projects) | (4) Date: B/E B=Beginning E=Ending | (5) Location | (6) How Funded | (7) Est. Annual Cost | (8) WG Project Rank |
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| | | - Wound Attractants | B - 1980<br>E - Open | Fargo, ND<br>Tuxtla, Gutierrez<br>Berkeley, CA | ARS<br>ARS<br>ARS | 144,000<br>10,000<br>5,000 | -<br>-<br>- |
| | | - Dried Blood Attractants | B - 1981<br>E - 1985 | Fargo, ND<br>Tuxtla, Gutierrez<br>Berkeley, CA | ARS<br>ARS<br>ARS | 50,000<br>25,000<br>5,000 | -<br>-<br>- |
| | | - Flower Attractants | B - 1981<br>E - Open | Fargo, ND<br>Tuxtla, Gutierrez<br>Berkeley, CA | ARS<br>ARS<br>ARS | 36,000<br>25,000<br>15,000 | -<br>-<br>- |
| | | - Calf Navel Cord Attractants | B - June 82<br>E - Open | Weslaco, TX<br>Fargo, ND<br>Tuxtla, Gutierrez | ARS<br>ARS<br>ARS | 15,000<br>5,000<br>5,000 | -<br>-<br>- |
| | | * Oviposition Stimulants | B - 1982<br>E - Open | Tuxtla, Gutierrez<br>Fargo, ND | ARS<br>ARS | 60,000<br>10,000 | -<br>- |
| | | *Trap Improvements | B - FY 83<br>E - FY 85 | Tuxtla, Gutierrez | ARS | 100,000 | - |

Attachment B

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Working Group (WG): Screwworm

Staff: International Operations & Screwworm Staff FY 1987

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Member W. H. Sudlow

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Chairperson * R. A. Bram

Member O. H. Graham

Member C. J. Whitten

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RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm

Fiscal Year: 87

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| | | | | Berkeley, CA | ARS | 5,000 | - |
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| | | | | Tuxtla, Gutierrez | ARS | 25,000 | - |
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| | | | | Fargo, ND | ARS | 5,000 | - |
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| | | | | Fargo, ND | ARS | 10,000 | - |
| | | *Trap Improvements | B - FY 83<br>E - FY 85 | Tuxtla, Gutierrez | ARS | 100,000 | - |

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm Fiscal Year: 88

| (1) Research Needs | (2) WG Need Rank | (3) Research Project (*= ongoing projects) | (4) Date: B/E B=Beginning E=Ending | (5) Location | (6) How Funded | (7) Est. Annual Cost | (8) WG Project Rank |
|---|---|---|---|---|---|---|---|
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| By the year 1988 the barrier zone should have been fully operative 2 years or more. Interest has already been expressed by IICA and the ministers of Agriculture to continue eradication through Central Amercia and the Caribbean. Thus, research for the barrier program should be focused primarily to improve quarantine procedures and improving sterile insect quality continuing strain development and other research projects, to insure that no fertile insects enter the barrier and that if they do their progeny are eliminated by the sterile male technique. Research to support future initiatives in Central America must continue in strain development, ecology and population dynamics, genetic population characterization, new rearing technologies, and chemical control technologies. | | | | | | | |

Circulate

United States Department of Agriculture

Agricultural Research Service

Southern Region
Insect Attractants, Behavior and Basic Biology Research Laboratory

1700 SW 23rd Drive
P.O. Box 14565
Gainesville, Florida
32604

*November 22, 1983*

*SUBJECT: Identification of participants in the ARS Workshop on "Chemical and Physiological Basis of Odorant-Mediated Insect Behavior" to be held on May 14-16, 1984*

*TO: Owen H. Graham, Research Entomologist*
*Screwworm Research Laboratory*
*Apartado 544*
*Tuxtula Gutierrez, Chiapas*
*Mexico*

*Please circulate this letter to scientists in your research group who may be interested in participating in the upcoming workshop: "Chemical and Physiological Basis of Odorant-Mediated Insect Behavior". The workshop will be in Gainesville, Florida, beginning Monday, May 14, and officially ending Wednesday, May 16, 1984. Participation is to be limited to 35-50 scientists, although accommodation for greater numbers may be possible. A copy of the tentative program is enclosed. The topics are broad in scope, but are not meant to be all-inclusive. Participants are encouraged to submit other topics they feel will better describe their investigations, but it should be noted that the emphasis of the workshop is to develop, identify, and discuss fundamental concepts and principles so that recommendations can be formulated for an ARS operational plan.*

*The format of the workshop will be similar to that of the Gordon Conferences. For each session there will be a small group of speakers discussing their research and integrating it into the existing pertinent body of knowledge. These presentations will be limited to between 15 and 45 minutes at the discretion of a chairman. A somewhat larger group having similar interests and research will participate in a question and answer period following and/or during each presentation to further develop and integrate the material into fundamental concepts and principles. The remaining scientists whose research and interests do not directly coincide with the subject of the session will comprise a body of observers who can also participate, although in a more limited way.*

*Each participant should submit one or more titles for each session in which he/she wishes to participate, along with a three or four sentence abstract for each title submitted. The session chairman and the program committee will then rank the submitted titles and finalize the program. Participants and observers will then be notified of final details. Each participant probably can expect to speak at least once. If a participant is interested in presenting further details of research or submitting material the program committee feels is outside the area of immediate interest, he/she should prepare a poster of the material. Four poster boards will be available. Each session chairman will appoint a small subcommittee to draft a document at the end of the workshop which summarizes the session and formulates recommendations for research in the topical area in the format of an ARS operational plan. The session chairmen will prepare and edit a final document.*

*The meeting will be held at the Holiday Inn-University Center, Gainesville, Florida. The cost of accommodations for 1984 will be $40+tax per night for a single and $44+tax for a double. Participants will be expected to make their own arrangements for rooms and travel. If you wish to share a room, submit your request with your titles and abstracts to or call M. S. Mayer, FTS-947-7263, who will keep a list of such requests and have the Holiday Inn send confirmation. Further information and details will be mailed to participants at a later date.*

*Please submit titles and abstracts to M. S. Mayer, USDA, ARS, P.O. Box 14565, Gainesville, FL 32604. The deadline for titles and abstracts is January 13, 1984. Contractual commitments and payment for a buffet dinner require a pre-paid registration fee of $25 (payable to Employees Association-Basic Biology). There can be no guarantee of participation for scientists submitting applications and titles after this date.*

*M. S. MAYER*
*Program Chairman*

*Enclosures: Program*
*Registration Form*

*ARS WORKSHOP: CHEMICAL AND PHYSIOLOGICAL BASIS OF ODORANT-MEDIATED INSECT BEHAVIOR*
*GAINESVILLE, FLORIDA*
*MAY 14-16, 1984*

*DAY 1 (Monday, May 14)*

*SESSION I: INTRODUCTION AND PURPOSE OF WORKSHOP*

| | | |
|---|---|---|
| 8:30- 8:45 | CALL TO ORDER . . . . . | HERBERT OBERLANDER |
| 8:45- 9:15 | PURPOSE OF WORKSHOP . . . . . | WALDEMAR KLASSEN |
| 9:15-10:15 | INVITED SPEAKER . . . . . | ---------- |
| 10:15-10:40 | BREAK | |

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*SESSION II: SENSATION AT THE RECEPTOR CELL*
*(M. S. Mayer, Chairman)*

10:40-12:30 TRANSDUCTION OF ODORS AT RECEPTOR CELL

--Brief review of theories
--New developments in neurophysiology, neurotransmitters, etc.
--General morphology of the antenna
--Fine structure of receptor cells
--Mechanism of response generation

12:30-2:00 LUNCH

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*SESSION III: DISCRIMINATION OF ODORANTS*
*(R. W. Mankin, Chairman)*

2:00-5:00 DISCRIMINATION BY INDIVIDUAL RECEPTOR CELLS

--Responses to odorant concentrations
--Differences among cells in pheromone-sensitive sensilla
--Responses to various chemicals
--Adaptation

CNS FUNCTIONS IN ODORANT-ELICITED BEHAVIOR

--Morphology of antennal lobe of deutocerebrum
--Gross morphology of parts of brain involved in coordinating pheromone-elicited behavior
--Sensory adaptation and central habituation
--Behavioral and neurophysiological effects of neurotransmitter interference

*DISCRIMINATION BY ENSEMBLES OF RECEPTOR CELLS*

*--Determination and morphology of response groups*
*--Information transfer and cross fiber coding*
*--The electroantennogram as a correlate of neurophysiological and behavioral responses*
*--Significance of receptor cell groups for behavior and structure-activity-relationships*
*--Use of psychophysical curves to relate neurophysiology to behavior*

*5:00-8:00* *DINNER*

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*SESSION IV: BASIS OF ODORANT-ELICITED BEHAVIOR*
*(----------, Chairman)*

*8:00-10:15* *DEFINITION OF ODOR-ELICITED BEHAVIOR*

*--Hierarchies of behavior: different levels of description*
*--Definition of repellency and attractancy*
*--Definition, usage, and necessity of terminology used for behavioral studies*
*--Development of assays based on defined principles*
*--Interpretation of assay results*

*******

*DAY 2 (Tuesday, May 15)*

*SESSION V: MECHANISMS OF ORIENTATION TO PHEROMONES*
*(J. H. Tumlinson, Chairman)*

*8:30-12:30* *OTHER STIMULI WHICH AFFECT AND EFFECT BEHAVIOR*

*--Determination and measurement of visual, physical, environmental, and other stimuli which affect and effect behavioral responses to odorants*
*--Field trap efficiency at high population-low population densities*
*--Examples to demonstrate specific principles and interpretations*
*--Cues for orienting to pheromone plumes*
*--Male moth pheromones*

*12:30-2:00* *LUNCH*

*SESSION VI: PHYSICO-CHEMICAL FACTORS AFFECTING PHEROMONE ELICITED BEHAVIORS (J. A. Klun, Chairman)*

*2:00-5:00*

*--Interpretation of structure-to-activity relationships based on molecular configuration and stereochemistry*
*--Use of biochemistry to predict released pheromones*
*--Maximization of trap captures and behavior modification through alteration of trace component ratios*
*--Meaning and use of dose-response data*
*--Formulating pheromones to provide proper release rates and ratios*
*--Interaction of concentration and composition of pheromone blends on behavioral responses*

---

*5:00-6:30* *INDIVIDUAL DISCUSSION*

*6:30-7:30* *DISCUSSION AND MIXER*

*7:30* *BUFFET DINNER*

*******

*DAY 3 (Wednesday, May 15)*

*SESSION VIII: RECOMMENDATIONS FOR ARSPLAN*

*8:30-10:15* *PRESENTATION OF WORKSHOP REPORTS*

*10:15-10:40* *BREAK*

*10:40-12:00* *DISCUSSION AND RECOMMENDATIONS*

*END OF WORKSHOP*

REGISTRATION FORM

ARS WORKSHOP: CHEMICAL AND PHYSIOLOGICAL BASIS OF ODORANT-MEDIATED INSECT BEHAVIOR
GAINESVILLE, FLORIDA - MAY 14-16, 1984

NAME: _____

ADDRESS: _____

_____

_____

TELEPHONE: FTS _____ COMMERCIAL _____

TITLE OF PRESENTATION: _____

_____

_____

ABSTRACT: (250 words maximum)

ESTIMATED LENGTH OF PRESENTATION (40 minutes maximum): _____

IMPORTANT:

(1) An advance registration fee of $25 must be enclosed. Make checks payable to: Employees Association, Basic Biology Laboratory.

(2) Please send enclosed room reservation card directly to the Holiday Inn-University Center or call M. S. Mayer, FTS 947-7263 to be assigned a shared room.

(3) Transportation from the airport to the Holiday Inn can be by rental automobile or by a courtesy van from the Holiday Inn.

(4) Please make copies of this form and submit one for each title.

Mail Registration Form to:
(Deadline: January 13, 1984)

M. S. Mayer
USDA, ARS, Insect Attractants Lab
P.O. Box 14565
Gainesville, FL 32604

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ARS WORKSHOP: CHEMICAL AND PHYSIOLOGICAL BASIS OF ODORANT-MEDIATED INSECT BEHAVIOR
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(Deadline: January 13, 1984)

M. S. Mayer
USDA, ARS, Insect Attractants Lab
P.O. Box 14565
Gainesville, FL 32604

REGISTRATION FORM

ARC NORDOMP: CHEMICAL AND ARTIFICIAL LURES OF
GONADAL-MATURED INSECT PARAPTOR
GAINESVILLE, FLORIDA - MAY 14-16, 1984

NAME: _____

ADDRESS: _____

_____

_____

_____

TELEPHONE: FTS _____ COMMERCIAL _____

TITLE OF PRESENTATION: _____

_____

_____

ABSTRACT: (250 words maximum)

ESTIMATED LENGTH OF PRESENTATION (40 minutes maximum): _____

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Mail Registration Form to: M. S. Mayer
(Deadline: January 15, 1984) USDA, ARS, Insect Attractants Lab
P.O. Box 14565
Gainesville, FL 32604

United States
Department of
Agriculture

Agricultural
Research
Service

Southern Region
Southeastern Fruit and
Tree Nut Research
Laboratory

P.O. Box 87
Byron, Georgia
31008

November 25, 1983

SUBJECT: Research Paper

TO: Dr. O. H. Graham
Dr. C. J. Whitten

Attached is a copy of the Central America paper in which both of you have been included as authors. Please review it and let me know if you think it is worth publishing and if so, where.

I am not sure where Ferrer's and Salinas' names should go. I have asked Frank Mulhern to give an opinion on this. He asked if I would write a summary of our study and I ended up including all four. This makes the credits more difficult but I believe it will make the paper better.

I look forward to your frank review.

J. Wendell Snow
J. WENDELL SNOW
Laboratory Director

Enclosure

United States Department of Agriculture
Agricultural Research Service
Southern Region
Southeastern Fruit and Tree Nut Research Laboratory
P.O. Box 87
Byron, Georgia
31008

November 25, 1983

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I look forward to your frank review.

J. Wendell Snow
J. WENDELL SNOW
Laboratory Director

Enclosure

12/10/83

Wendell -
Pardon the informal reply but am heading Statesside tomorrow for Christmas vacation. The paper is certainly a worthwhile undertaking, I understand the need for it and commend you for being willing to undertake it. I will as soon as possible send you a "peer review" type of review and will be glad to help in other ways if you wish. However, I do not want to co-author the paper. There are enough judgemental findings or statements where my opinion differs enough from your's to cause me to want to withdraw. That

(over)

group, 2 or 3 people would be enough, should be assigned to the project to make a solid, in depth study. This could be accomplished in 12 months but probably not much sooner -

Merry Christmas,
Hugh

is not to say that I think you are wrong and I am right - its a matter of opinion and I have to stick with mine as presented in the 1980 and 1981 committee reports. I think the job can be accomplished with about half your estimated cost. I do not believe flies should be trucked to a distribution center in El Salvador - a better scheme would be to ship by cargo plane to a DC in San Pedro Sula, Honduras. These are examples of differences in opinion but at this point none of us have enough info to be sure. a study

HEALTH-CHEM CORPORATION

1107 BROADWAY • NEW YORK, NEW YORK 10010 • TELEPHONE (212) 691-7550
TELEX NO. 4992962 HCHEM

HERCON DIVISION

November 28, 1983

Dr. Harold E. Brown
USDA-ARS
P.O. Box 267
Weslaco, Texas 78596

Ref: W/276/arq

Dear Harold:

Per our telephone conversation, we will provide you with the following products:

1) 20% Vapona. 1/8" x 1/8" confetti, 10 lbs

2) Vapona + Swormlure - 4 + dryblood + sugar, 1/4" x 1/4" confetti, 10 lbs; the above ingredients will be present in the reservoir in the following ratio: 20:24:28:28.

3) 20% Vapona and 24% Swormlure-4, 1/4" x 1/4" confetti, 10 lbs

4) 24% Swormlure, 1/4" x 1/4" confetti, 10 lbs

5) Phero-tac sticker, 2½ gallons

The last item is for evaluating the attractiveness of dry blood + sticker in pherotac --- which may be used in conjunction with Product No. 3, as described above.

We will also be sending you the analytical procedure for determining amount of Vapona in our Hercon dispensers.

I will be attending the ESA meeting in Detroit this week. If there are any questions, please call Ms. Laura Zeoli in New York, or Dr. Beroza in Maryland. I will be in the office on December 5.

Thank you very much.

Sincerely,

A.R. Quisumbing (ey)

Alberto R. Quisumbing, Ph.D.
Director, Product Development

ARQ/tt

United States Department of Agriculture
Agricultural Research Service
Southern Region
Southern Plains Area
Screwworm Research Lab
Apartado Postal #544
Tuxtla Gutierrez, Chiapas
Mexico

December 6, 1983

SUBJECT: Visit to Methods Development and Screwworm Production Facility

TO: O. H. Graham
Location/Project Leader

On 6 December 1983 at 10:30 hours I made a visit to the screwworm plant. The reason for my trip was to see first hand the development of the new strain 083 in Methods and the current production A82 on the floor. After a brief discussion with Dr. E. Gersebeck, Mr. R. Ramirez and Mr. R. Cavazos, I inspected the rearing floor and gathered impressions on the status of A82 (now in mass production for over a year). Quite simply I was very impressed with how A82 is being reared. Larval size in some groups is over 70 mg, I observed no problem with early crawl off, vats were being vacuumed and fed well, and the electrocutor grids have reduced the housefly problem significantly. In short, I have never seen the rearing operation going along so well. The only thing I did observe (and I don't mean to be nit-picking) was dermested larvae in some of the catch pans below the larvae/pupae separater belt. I commend all involved on keeping a good strain in production for over a year.

I then chatted with Raquel and Felipe in the Methods Section. According to their records, larval size of 083 is consistently below 70 mg even though the 1st generation of all 21 groups ARS supplied them averaged over 70 mg after the first generation on hydro. Also, the "rendimiento biológico" is below 100% (50% yield) and is in contrast to previous strains. Larvae are being blown into piles and scooped off the floor. In my June visit report I said, "I thought they had built a new crawl off collection system". Construction of the new Methods is proceeding with the general layout now apparent. Walls were being painted white and when the renovation is complete will provide Methods with a much improved facility.

The amount of damage done to 083 is difficult to assess. The stress put on the strain during its makeshift rearing while construction is going on is impossible to evaluate. Not knowing the results of the Palenque (083) and Campeche (A82) concurrent field evaluation I can not comment on the 083 strains ability to perform in the field. The Methods Section will no doubt present a variety of data at the strain change meeting comparing A82 and 083 now and when they were being reared in Methods. I do know that 083 while it was in ARS was the best strain in which I have been involved. Whether the program managers decide to change to 083 is yet to be decided. They will have more and better biological data available to them than in the past. If 083 is not put into production the new Method Section will at least have a shining new facility that will have cost the Commission and ARS more than they know.

RICHARD D. PETERSON II
Research Entomologist (ARS)

United States Department of Agriculture
Agricultural Research Service
National Program Staff
Beltsville, Maryland 20705

December 7, 1983

SUBJECT: Identification of Participants in the ARS Workshop on "Chemical and Physiological Basis of Odorant-Mediated Insect Behavior" to be Held on May 14-16, 1984

TO: Research Leaders

This is an important Workshop that will serve as an inspiration and guide to our research for the next few years. Because of many factors, including the size of the meeting, other committments, and travel ceilings, not everyone will be able to attend. However, we suggest that your ideas regarding the various subjects as well as those of other scientists in your Unit, can be integrated into the Workshop by sending a short description of your research interests and plans as well as other comments to the appropriate Session Chairperson.

Please circulate this information to all interested scientists.

Robert D. Jackson
ro

ROBERT D. JACKSON
National Program Leader
Entomology

Leo LaChance

LEO LaCHANCE
Acting National Program Leader
Basic Insect Biology

Enclosure

cc:
M. S. Mayer

United States Department of Agriculture
Agricultural Research Service
Southern Region Insect Attractants, Behavior and Basic Biology Research Laboratory
1700 SW 23rd Drive
P.O. Box 14565
Gainesville, Florida 32604

November 22, 1983

SUBJECT: Identification of participants in the ARS Workshop on "Chemical and Physiological Basis of Odorant-Mediated Insect Behavior" to be held on May 14-16, 1984

TO: Robert D. Jackson, NRPL
Entomology
USDA ARS NPS CPDS
Rm. 331B, B-005, BARC-W
Beltsville, MD 20705

Please circulate this letter to scientists in your research group who may be interested in participating in the upcoming workshop: "Chemical and Physiological Basis of Odorant-Mediated Insect Behavior". The workshop will be in Gainesville, Florida, beginning Monday, May 14, and officially ending Wednesday, May 16, 1984. Participation is to be limited to 35-50 scientists, although accommodation for greater numbers may be possible. A copy of the tentative program is enclosed. The topics are broad in scope, but are not meant to be all-inclusive. Participants are encouraged to submit other topics they feel will better describe their investigations, but it should be noted that the emphasis of the workshop is to develop, identify, and discuss fundamental concepts and principles so that recommendations can be formulated for an ARS operational plan.

The format of the workshop will be similar to that of the Gordon Conferences. For each session there will be a small group of speakers discussing their research and integrating it into the existing pertinent body of knowledge. These presentations will be limited to between 15 and 45 minutes at the discretion of a chairman. A somewhat larger group having similar interests and research will participate in a question and answer period following and/or during each presentation to further develop and integrate the material into fundamental concepts and principles. The remaining scientists whose research and interests do not directly coincide with the subject of the session will comprise a body of observers who can also participate, although in a more limited way.

Each participant should submit one or more titles for each session in which he/she wishes to participate, along with a three or four sentence abstract for each title submitted. The session chairman and the program committee will then rank the submitted titles and finalize the program. Participants and observers will then be notified of final details. Each participant probably can expect to speak at least once. If a participant is interested in presenting further details of research or submitting material the program committee feels is outside the area of immediate interest, he/she should prepare a poster of the material. Four poster boards will be available. Each session chairman will appoint a small subcommittee to draft a document at the end of the workshop which summarizes the session and formulates recommendations for research in the topical area in the format of an ARS operational plan. The session chairmen will prepare and edit a final document.

*The meeting will be held at the Holiday Inn-University Center, Gainesville, Florida. The cost of accommodations for 1984 will be $40+tax per night for a single and $44+tax for a double. Participants will be expected to make their own arrangements for rooms and travel. If you wish to share a room, submit your request with your titles and abstracts to or call M. S. Mayer, FTS-947-7263, who will keep a list of such requests and have the Holiday Inn send confirmation. Further information and details will be mailed to participants at a later date.*

*Please submit titles and abstracts to M. S. Mayer, USDA, ARS, P.O. Box 14565, Gainesville, FL 32604. The deadline for titles and abstracts is January 13, 1984. Contractual commitments and payment for a buffet dinner require a pre-paid registration fee of $25 (payable to Employees Association-Basic Biology). There can be no guarantee of participation for scientists submitting applications and titles after this date.*

*M. S. MAYER*
*Program Chairman*

*Enclosures: Program*
*Registration Form*

ARS WORKSHOP: CHEMICAL AND PHYSIOLOGICAL BASIS OF
ODORANT-MEDIATED INSECT BEHAVIOR
GAINESVILLE, FLORIDA
MAY 14-16, 1984

DAY 1 (Monday, May 14)

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| 8:30- 8:45 | CALL TO ORDER . . . . . | HERBERT OBERLANDER |
| 8:45- 9:15 | PURPOSE OF WORKSHOP . . . . . | WALDEMAR KLASSEN |
| 9:15-10:15 | INVITED SPEAKER . . . . . | ---------- |
| 10:15-10:40 | BREAK | |

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(M. S. Mayer, Chairman)

10:40-12:30 TRANSDUCTION OF ODORS AT RECEPTOR CELL

--Brief review of theories
--New developments in neurophysiology, neurotransmitters, etc.
--General morphology of the antenna
--Fine structure of receptor cells
--Mechanism of response generation

12:30-2:00 LUNCH

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SESSION III: DISCRIMINATION OF ODORANTS
(R. W. Mankin, Chairman)

2:00-5:00 DISCRIMINATION BY INDIVIDUAL RECEPTOR CELLS

--Responses to odorant concentrations
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CNS FUNCTIONS IN ODORANT-ELICITED BEHAVIOR

--Morphology of antennal lobe of deutocerebrum
--Gross morphology of parts of brain involved in coordinating pheromone-elicited behavior
--Sensory adaptation and central habituation
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--Use of psychophysical curves to relate neurophysiology to behavior

5:00-8:00 DINNER

---

SESSION IV: BASIS OF ODORANT-ELICITED BEHAVIOR
(----------, Chairman)

8:00-10:15 DEFINITION OF ODOR-ELICITED BEHAVIOR

--Hierarchies of behavior: different levels of description
--Definition of repellency and attractancy
--Definition, usage, and necessity of terminology used for behavioral studies
--Development of assays based on defined principles
--Interpretation of assay results

*******

DAY 2 (Tuesday, May 15)

SESSION V: MECHANISMS OF ORIENTATION TO PHEROMONES
(J. H. Tumlinson, Chairman)

8:30-12:30 OTHER STIMULI WHICH AFFECT AND EFFECT BEHAVIOR

--Determination and measurement of visual, physical, environmental, and other stimuli which affect and effect behavioral responses to odorants
--Field trap efficiency at high population-low population densities
--Examples to demonstrate specific principles and interpretations
--Cues for orienting to pheromone plumes
--Male moth pheromones

12:30-2:00 LUNCH

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2:00-5:00

--Interpretation of structure-to-activity relationships based on molecular configuration and stereochemistry
--Use of biochemistry to predict released pheromones
--Maximization of trap captures and behavior modification through alteration of trace component ratios
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--Formulating pheromones to provide proper release rates and ratios
--Interaction of concentration and composition of pheromone blends on behavioral responses

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5:00-6:30 INDIVIDUAL DISCUSSION

6:30-7:30 DISCUSSION AND MIXER

7:30 BUFFET DINNER

*******

DAY 3 (Wednesday, May 15)

SESSION VIII: RECOMMENDATIONS FOR ARSPLAN

8:30-10:15 PRESENTATION OF WORKSHOP REPORTS

10:15-10:40 BREAK

10:40-12:00 DISCUSSION AND RECOMMENDATIONS

END OF WORKSHOP

SESSION VI: PHYSICO-CHEMICAL FACTORS INFLUENCING AIRCRAFT SURFACE BEHAVIOUR (D. A. Kuhn, Chairman)

2:00-3:00 —Interpretation of structure-property-design in aluminium based on volatile conditioning and aerokinetics
—Use of ultrasonics to predict material properties
—Mathematics of step capacity and behavior modification through air-mixing of tests
—Summary and use of data centrum data
—Electrochemical techniques to provide proper coating sales and radio
—Interaction of contamination and corrosion of fiberglass plants on behavioral characteristics

3:00-3:10 INDIVIDUAL DISCUSSION

3:10-3:30 DISCUSSION AND MEETING

3:30 ADJOURNMENT

*******

DAY 3 (Wednesday, June 3rd)

SESSION VII: RECOMMENDATIONS FOR ARSENAL

8:30-10:15 PRESENTATION OF WORKING GROUPS

10:15-10:30 BREAK

10:30-12:00 DISCUSSION AND RECOMMENDATIONS

END OF WORKSHOP

REGISTRATION FORM

ARS WORKSHOP: CHEMICAL AND PHYSIOLOGICAL BASIS OF ODORANT-MEDIATED INSECT BEHAVIOR
GAINESVILLE, FLORIDA - MAY 14-16, 1984

NAME: _____

ADDRESS: _____

_____

_____

TELEPHONE: FTS _____ COMMERCIAL _____

TITLE OF PRESENTATION: _____

_____

_____

ABSTRACT: (250 words maximum)

ESTIMATED LENGTH OF PRESENTATION (40 minutes maximum): _____

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Mail Registration Form to:
(Deadline: January 13, 1984)

M. S. Mayer
USDA, ARS, Insect Attractants Lab
P.O. Box 14565
Gainesville, FL 32604

1 Dec. 1983

Dear Hugh,

How are you? Sure hope things are corriendo muy bien for you. I heard from Bob through Allen that the plastic material for the mats is in Tuxtla. Good!

I'm sending you a copy of an article that I wrote with the intention of submitting it to a reporter from the Times or Mountain Sun.

Let me explain the principle reasons for writing the article. I want some recognition, not for me personally, but for my family. If it were just me alone I wouldn't give a damn. But—I worked down there a long time and I worked hard. When I came back no one said a word about me leaving, and some of my kids just couldn't understand why there wasn't something in the paper or some little present made to me while I was still there. (I can understand and I'm sure you do too—but that still dosen't make it OK with the kids.) Also , perhaps if the article is published the kids and Susie will not wonder so much about me working for free.

Perhaps the article is premature. If it is—it can be updated and presented later. The main thing I wanted from you was criticism. If you have time would you see if you think it will float. I want something that APHIS and ARS can swallow, and I want something that you fully approve (I've taxed your good nature enough.)

I'm not sure of my numbers.

I believe that they vacumn every 8 hours.

I figured that 600,000,000 pupae/wk = 60,000 liters/wk or 8,570 liters/day, that 8,570 liters represented 952 vats (8,570/9 liters per vat), and that each vat is 12 $ft^2$—so 952 vats X 12 $ft^2$ = 11,424 $ft^2$ or 1270 $yds^2$.

I figured that each vat must contain 1 cu ft of acetate so there is 950 cu ft of waste acetate daily.

I think that the killing temperature for larvae that they use is 110-120° F and that they expose the material for at least 24 hours.

I think that they they figure that the cost of pupae is $10.00/liter and that 60,000 liters/wk comes to $600,000/wk --- $600,000 X 52 wks = $31 million/year.

Hugh PLEASE don't waste time with this. If you can give it some time—good, I need to have the figures in the ballpark. If you can't do anything with it I'll get it straight when I'm in Tuxtla the next time.

Sincerely,

Hop

ps: My menory told me that 1966 was the year Texas was officially eradicated; that may not be correct.

LOCAL MEN STILL AID IN SCREWWORM BATTLE

Residents of Kerrville and the rest of Texas during the 1950's can recall that work to eradicate a flesh eating maggot, larva of the screwworm fly (a severe pest of livestock), from the Americas began in the laboratories of the USDA in the Kerrville area. Those interested in the progress of the effort will recall that sexually sterile screwworm flies when mixed with fertile populations can depress reproductive rates to such levels that reproduction ceases, and that this phenomenom was first studied in cages here in Kerrville, later observed in nature in the West Indies, and that vicious stubborn infestations were eradicated from the Southeastern and Southwestern U.S. by 1966.

Names familar to Kerrvillites, R. C. Bushland, O. H. Graham, and D. E. Hopkins have long been associated with the effort to free the Americas from screwworms, and their thought and work yet effect that program. (The names of Bushland and Hopkins are on an historical marker on the grounds of The Livestock Insects Laboratory near the building that housed the first experiments with sterile screwworms.) Sexually sterile screwworm flies are currently being produced and released by the U.S. and Mexico. The program necessitates the rearing of 400-600 million flies every week. Men from the Kerrville area are developing a new method for artificially rearing the larvae of this fly that promises to reduce the cost of mass producing the sterile insects by several million dollars/pesos per year.

Currently, in a production facility, The Screwworm Plant, near Tuxtla Gutierrez in the state of Chiapas in Mexico about 30 millions of dollars/pesos are spent yearly to rear the flies that are used as weapons against their own kind.

Screwworm larvae in open wounds of warmblooded animals, the natural condition, or in artifical diet in the Screwworm Plant require the support of a semisolid so that they may assume, while feeding (mostly on fluids), a fixed attitude, posterior outward; this allows them to constantly respire air through breathing tubes called spiricales.

In hosts, the animal tissue and concentrations of companion larvae support the feeding posture; in the Plant, inch thick mats of acetate (resembles cotton batting) that are soaked with a fluid diet substitute for animal tissue. The diet is a mixture of blood, egg, milk, formaldehyde, and water, and substitutes for the body fluids of natural hosts. Larvae that are minute in size when newly hatched and that grow in their 5-day growing-period to the size of inch long catipillars, are reared the 3rd, 4th, and 5th days of their growth in vats containing the acetate mats and diet. Every 8 hours fluid from the 1270 square yards of mats in the Plant is sucked off by workers using vacumn tubes in order to discharge waste products and to allow the replenishment of fresh diet. The mats are not reusable and are replaced every 3 days. The 950 cu ft of waste wet acetate that accumulates daily needs to be stored in 110-120° F for 24 hrs to kill lingering larvae (an absolute necessity to prevent the escape of fertile flies) and then burned or buried.

It is readily evident that reusable mats and a system of gravity-flow to discharge waste diet would permit savings in labor and material, and would eliminate costly and perhaps hazardous burning or burying of acetate; therefore, to start which is perhaps the most recent technical development in the program for eradication of screwworms D. E. Hopkins in the fall of 1982 demonstrated in small tests (using glass beads) in Tuxtla Gutierrez that such a system could be devised. He was then working for the Animal and Plant Health Inspection Service (APHIS) of the USDA (the agency that operates the Screwworm Program.) At that time Hopkins was nearing the end of a 4 1/2 year tour of work in Mexico and didn't have the time or influence necessary to properly interest his agency in the process. The Agricultural Research Service (ARS) of the USDA supports APHIS with research and after Hopkins retired in Jan. 1983 Dr. O. H. Graham who heads Screwworm Research in Mexico recognized that more development in the field of larval rearing was a technical and economic possibility and therefore, a technical and economic responsibility. Dr. Graham asked Texas A & M to hire Mr. Hopkins and send him to Mexico, through a cooperative agreement, to do more work on innovations in rearing. Hopkins returned to Tuxtla Gutierrez in June 1983 with some

To locate, the animal diseases and overproduction of inexpensive barrels supply the food-
low-cholesterol in the Plants, have eight pads of protein (resembling cotton batting)
that are soaked with a fluid that substitutes for animal tissue. The diet is a mixture
of blood, egg, milk, formaldehyde, and water, and substitutes for the body fluids of
natural foods. Barrels that are chosen to rise when newly treated and kept upon in
tubes 5-day growing-period in the size of 1001 long containers, are taken at the 3rd,
4th, and 5th days of their growth in order to determine the growth rate and size.
Nearly 8 hours light from the 1st source yields an area in the flight is carried out by
workers under vacuum hoses in order to dismantle every 10 days and to allow the re-
placement of fresh diet. The pads are not reusable and are replaced every 5 days.
The 250 cm of vessels was results that manipulation daily needs to be carried in
110-120° F for 22 hrs to kill (inactivate) Serres (an absolute necessity to prevent the
emergence of fertile fleas) and sterilized or burned.

It is readily evident that reusable pads and a system of pressure-flow to discharge
waste also would result savings in labor and material, and would eliminate costly
and painful accidents involving or burying of contrary insectivore. In other words an ex-
haps the most recent technical developments in the process for manufacture of mechanoma
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Mexico and had him to Mexico through a cooperative agreement, to do more work on
larvicides in rearing. Hopkins returned to Pirrle Quitarra in June 1967 with some

plastic dish-scrubbers bought at a supermarket in Kerrville and was able to construct with them a small reusable mat that he used to produce more large larvae per unit of space than is possible in the Plant.

Hopkins and another area resident, Dr. J. A. MIller, an engineer, along with an entmologist, Dr. R. L. Harris (formally of Kerrville—now at Texas A & M), plan to work on final development of the resuable-mat-gravity-flow system at Dr. Graham's laboratories in Tuxtla Gutierrez early in 1984. A perfected system would save an estimated 1-2 million dollars/pesos, annually, in material and perhaps 1-2 million more in labor and convience.

Area residents who recall Dr. Bushland will be interested to know that he is still retired and plans to move from McAllen, Texas back to Kerrville in 1984; when he serves the Screwworm Program it is as an unpaid collaborator for ARS or APHIS. Mr. Hopkins also is retired, lives in Kerrville, and is a collaborator for ARS. Dr. Miller lives in Kerrville and works for The Livestock Insects Laboratory. Dr. Harris works for ARS in College Station Tex. and lives in that area. Dr. Graham lives in Kerrville and Tuxtla Gutierrez.

So, you see, Kerrville was where a continent-wide effort began and is where part of the battle still goes on.

plants chemurgists based at a supermarket in Kerrville and was able to convince with them a small company that they had to produce more large lemons per unit of space than is possible in the plant.

Hopkins and another area resident, Dr. J. A. Miller, an engineer, along with an optical-expert, Dr. L. Gerts (formerly of Kerrville—now at Texas A & M) plan to work on final development of the rocket-and-gravity-free system at Dr. Gerhart's Laboratories in Santa Barbara early in 1981. A practical system would save an estimated 1-2 billion dollars/year, mainly, in material and perhaps 1-2 million man in labor and overhead.

Area residents who recall Dr. Hopkins will be interested to know that he is still from time and plans to move back to Kerrville in 1981, when he retires the Brownwood Figures it is an ideal solution for AMT or AFSTM. Dr. Hopkins also is married, lives in Kerrville, and is a coordinator for AMS. Dr. Miller lives in Kerrville and works for the Lowstock Chemical Laboratory. Dr. Gerts works for AMS in College Station Tex. and lives in that area. Dr. Gerhart lives in Kerrville and teaches Dallas.

So, you see, Kerrville was where a continent-wide effort began and is where part of the battle still goes on.

United States Department of Agriculture
Agricultural Research Service
Southern Region
Southern Plains Area
Screwworm Research Lab
Apartado Postal #544
Tuxtla Gutierrez, Chiapas
Mexico

1 copy circulated to all scientists

December 7, 1983

SUBJECT: Report on ESA Annual Meeting

TO: O. H. Graham

I attended the annual meeting of the Entomological Society of America in Detroit, Michigan, from 28 November through 2 December. In general, I was disappointed in the program contents. Herein I report some highlights that may be of interest to others here in Tuxtla.

A meeting of ARS scientists was conducted on Tuesday 29 Nov. at 07:00 hrs. Ed Kindrick and Ed Knipling presented information on the realignment of ARS; some specifics follow.

Assistant Secretary Orville Bentley is responsible for directing SEA.

Ed Kindrick is the director of the Office of Grants and Program Systems; he will review competitive grants in 4 areas (genetic mechanisms, biological stress, photosynthesis, and nitrogen fixation) - they are authorized to disburse $50 million.

Realignment of ARS will enhance research programs by placing $10 million in overhead and administration into research programs.

Wally Klausen is now director of the Beltsville Research Center; his vacancy on NPS will be filled - in December and January, Leo LaChance will be acting in his capacity on NPS.

The first increment of change was announced in mid-November reflecting a shift to new areas of focus; no change in personnel or locations will result. Detailed changes have been mailed to Area Directors, etc.

Research in entomology receives $60 million - 15% of ARS budget - the largest area within ARS. There will be a net reduction of $5 million achieved largely through attrition; no firings or RIFs will occur - only 18% of the total number of programs will be changed.

Highlights of medical entomology. The causative agent of lyme arthritis has been identified as *Borrelia burgdorferi*. Vectors include the hard tick *Ixodes damani* (80% infectivity rates in field populations) and *I. pacificas* (1-2% infectivity rates in field populations). To date, 487 cases have been reported in 12 of 17 states surveying for the disease. Tetracycline and penicillin are used successfully. Thirty six cases of plague have been reported this year; this is almost 3 times the normal incidense. Most cases have been in native Americans in New Mexico. Scabies and pubic lice are now listed as sexually transmitted diseases. Malaria is increasing in incidence in alarming rates. Some specifics: malaria is

increasing rapidly in Mexico, in 4 countries of C. A. malaria is "runaway" with insecticide resistence, drug resistence, and political problems precluding field work. Chloroquin resistant strains of P. falciparum are now wide spread in the old world (especially Africa and the orient) and east of the Panama Canal. Strains resistant to Fansidar have been isolated from 3 areas (areas not specified - probably orient).

Highlights of veterinary entomology. This presentation was the major disappointment. The speaker was a canadian named G. Surgeoner from the University of Guelph. His presentation focused principally on his research concerning ear tags treated with pyrethrins. Some resistence had been noted in past years - this is now widespread. Much of his time was spent complaining of the USDA-ARS realignment and reduction in animal production funding. He did mention a "very important" joint U.S. - Canada cattle grub control program ($100,000 funding). At the conclusion of his presentation, I announced the current state of the screwworm eradication program and recommended that those present visit the poster display prepared by Chuck MacVean.

Other papers and comments. The Livestock Insect Conference will be held from noon on Monday 9 July to noon Friday 13 July at the Sheraton Inn, West Lafayette, IN.

A major epizootic of vesticular stomatitis occurred in 1982-1983. Seven viral strains were isolated. Cases were confirmed in 614 of 1144 animals tested; 313 cases occurred in Colorado. House flies and face flies frequently were noted to be virus positive; "they likely are responsible in part for transmission".

Some 40 laboratories around the world are working on the development of vaccines for malaria. Vaccines are being developed against the sporozoite stage, the exoerythrocytic stage, asexual blood stages, and also the gamete stage. The latter is termed the "entomologist's vaccine" because, in essence, it protects the mosquito from infection. This vaccine is altruistic since it protects unifected "neighbors" but does nothing for infected individuals. Immunity is long term (at least 6 yrs). There are drawbacks and difficulties with each method. The author (Bob Gwadz, NIH) concluded that polyvalent vaccines are likely to result and will be ready for field tests in 5-7 years - a commercial product is probably 10 yrs. distant. Vaccines likely will not be applicable universally and may not work in Africa. Bob concluded that regardless of success in the development of vaccines, vector control will be needed always.

I talked at length with Ed Marks, ARS Technical Advisory for Physiology (Fargo, ND) about fluorescent marks for spermatozoa or seminal fluid proteins. We discussed several possibilities including the use of fluorescent-tagged antibodies specific for circumspermatozoal proteins. This may be a viable option since I have some experience in the production and purification of antibodies. We will be communicating over the next few weeks.

R. J. Brenner

RICHARD J. BRENNER
Research Entomologist

Increasing rapidly in Mexico, in 4 provinces of C. A. malaria is "running" with insecticide resistance, drug resistance, and political problems prevailing field work. Chloroquin resistant strains of P. falciparum are now with spread in the old world (especially Africa and the orient) and east of the Panama Canal. Strains resistant to Fansidar have been isolated from 4 areas (areas not specified - probably orient).

Mobilization of veterinary entomology. This presentation was the major disappointment. The speaker was a consultant named R. Brueckner from the University of Cornell. His presentation focused primarily on his research concerning sar flys transmitted with parasitisms. Some restrictions had been made in past years - this is now widespread. Much of his time was spent complaining of the USDA-ARS realignment and reduction in animal production funding. He did mention a "very important" job - change cattle dipping program (£100,000 funding). At the conclusion of his presentation, I commented the current state of the screwworm eradication program and recommend that those present visit the Center Hospital prepared by Chuck Hayden.

Other topics and comments. The Diversity Impact Conference will be held here on Monday 6 July as soon Friday 13 July at the Sheraton Inn, West Lafayette, Ind.

A major epidemic of vesicular stomatitis occurred in 1982-1983. Seven viral strains were isolated. These were confirmed in old of 1983 animals caught 013 cases reported in Colorado. These flies are Culex flies frequently were noted to be plume positives "very likely are responsible in part for transmission".

Some 40 laboratories around the world are working on the development of vaccines for malaria. Vaccines are today developed against the sporozoite stage, the cryptozoitic stage, asexual blood stages, and also the gametic stage. The latter is termed the "endomolecular vaccine" because, in essence, it protects the mosquito from infection. This vaccine is virtually alone it protects individual "mosquitoes" but does nothing for infected individuals. Immunity is long term (at least 3 yrs). There are drawbacks and difficulties with such method. The author (Gen Smith, NIH) concluded that polyvalent vaccines are likely to result and will be ready for field tests in 5-7 years - a commercial product is probably 10 yrs. Malaria. Vaccines likely will not be applicable universally and may not work in Africa. Don concluded that regardless of success in the development of vaccines, vector control will be needed always.

I talked on lesion with 40 trials. NIH Technical Advisory for Pyelology (Page, MD) about fluorescent media for specimens or medical field problem. We discussed several possibilities including the use of fluorescent tagged antibodies specific for chromosomal processing. This may be a viable option since I have some experience the production and purification of antibodies. We will be communicating over the next few weeks.

Richard H. Gordon
Research Entomologist

Graham

United States Department of Agriculture | Agricultural Research Service | National Program Staff | Beltsville, Maryland 20705

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December 13, 1983

SUBJECT: Trip Report--Screwworm Eradication Program in Mexico

TO: D. B. Laster, ADA, AHNPSS

Location:
(a) Oaxaca, Mexico (Mexico-America Screwworm Commission Meeting)
(b) Tuxtla Gutierrez, Mexico (Screwworm Strain Change Meeting and Site Visit)

Dates:
(a) December 6, 1983
(b) December 7-9, 1983

Participants:
(a) Screwworm Commission members, with Assistant Secretary McMillan acting as meeting chairman; Screwworm Commission Co-Directors and selected program officials from APHIS-VS including the Administrator, Deputy Administrator for Veterinary Services, and Assistant Deputy Administrator for Screwworms and International programs; representatives of IICA and Jamaica. ARS was represented by the Screwworm Research Project Leader and the NPL for Insects Affecting Man and Animals.

(b) All participants of the Screwworm Commission meeting, except the Commissioners, ARS Research Scientists at Tuxtla Gutierrez, and Screwworm Commission Methods Development and Production personnel.

Results:
(a) The Screwworm Eradication Program has made exceptional progress during the past year--perhaps the most successful year in the history of the program. Following presentations updating the Commission on the status of field operations, production, methods development, ARS research (presented by Dr. O. H. Graham), and administration, the Commission approved, without substantive debate, the 1984 budget which amounts to $50 million, of which the U.S. contributes 90%. The objective of the program is to establish a barrier zone at the Isthmus of Tehuantepec by December 1984. Inasmuch as sterile flies are already being released all the way to the Mexico-Guatemala border, there is every reason to expect achievement of the objective, barring unforeseen setbacks or unanticipated problems.

Representatives of Jamaica indicated their desire to initiate eradication in their country and requested technical and operational support. The Screwworm Commission encouraged Jamaica to continue to pursue this goal, but offered no tangible support at this time. In addition, the Screwworm Commission received a letter from officials in Guatemala requesting that they join the Mexico-American Commission in order that screwworm eradication could continue through their country.

During the informal segments of the Commission meeting, Dr. Bud Turner approached me requesting permission for Dr. Richardson of the University of Texas to visit Mexico during the Christmas holidays in order to collect screwworm specimens for further research. I responded that ARS would not presume to either grant nor deny permission to work in Mexico; however, I indicated that ARS does not have resources to support Dr. Richardson's activities in any way. In further discussions on this subject with Assistant Secretary McMillan, Mr. Bert Hawkins, and other APHIS-VS program officials, I expressed my belief that none of Dr. Richardson's activities would benefit the screwworm eradication program. All agreed to this position and Dr. Turner was advised that should Dr. Richardson continue to require field collections, Belize (an English speaking country on the Yucatan Peninsula) would be his best possibility.

(b) During the strain change meeting in Tuxtla Gutierrez, consideration was given to changing from production of the Arriaga strain, which has been in use for 1 year. This decision is extremely critical to the success of the eradication program and rests solely with the Screwworm Commission Co-Directors with technical input from ARS and the Commission Methods Development group. After excellent presentations and very productive discussions, the Co-Directors accepted the following proposal from the Chief of Operations:

(1) Continue production of the Arriaga strain in the plant.
(2) Increase production of the Oaxaca strain in methods development and release irradiated flies in separate areas.
(3) Intensify quality control and field evaluation of both strains.
(4) Assess effectiveness of the Arriaga strain in April and, if indicated, change to the Oaxaca strain at that time.
(5) If a strain change is not made in April, discard the Oaxaca strain and change to a new strain, Villa Flores, in August.

In discussions with the individual ARS Research Scientists and Project Leader at Tuxtla Gutierrez, I was impressed with their technical excellence, their enthusiasm for research opportunities, and the overall quality of their work under adverse conditions. Research at Tuxtla Gutierrez is not only specifically targeted to the needs of the action program (strain development, for example), but also includes many fundamental components which have long-term applications (such as screwworm population genetics).

Observations:

(a) As the eradication program rapidly approaches the barrier zone in the Isthmus of Tehuantepec, countries of Central America and the Caribbean will exert pressure to establish a new barrier zone at the Panama-Colombia border. ARS should begin to consider the feasibility of establishing a satellite laboratory, perhaps in Costa Rica, in order to generate necessary research in advance of eradication in new areas. Even now, field research in virgin areas is limited in Mexico to the Yucatan Peninsula. In my opinion, ARS should assist Jamaica to establish a research capability during 1984, within the limits of existing budget and personnel ceilings.

D. M. Lester

During the informal sessions of the Consultation meeting, the participants expressed an important observation that the Bureau's Office of Tropical Meteorology is in a position to assist Mexico during the Observing Subplan in order to provide accelerated impetus for Mexico's campaign. It emerged that AMS would be prepared to provide some manpower assistance in data or meteorological services, and that USWB would not only encourage the support of Dr. Bigelow's activities in any way, but further discussions on this subject with Assistant Secretary Wirtzman, Dr. Harry Wexler, and Mr. Wade Smith-Vaniz proceed actively. I am sure that Mexico at the Consultation decided that such a request would be a very valuable contribution and an excellent opportunity for us. All agreed that the Mexican delegation was correct in what should be, strictly speaking, a negative field calculation, believe the English speaking contingent was vacuum intensively would be a less possibility.

(b) During the storm change meeting in Puerto Ordaz, some discussion was given to changing from geostrophic at the Arrecife station, which has been in use for 1 years. This decision is strongly contrary to the success of the modification program and rests solely with the Economic Commission for Mexico with technical input from AMS and the Meteorologic Meteorologist group. After exhaustive presentations and very productive discussions, the conference accepted the following proposal from the chief of Mexico:

(1) Continue production of the Arrecife station at the plant.
(2) Increase coordination of the Bureau's [illegible] Meteorologist and release [illegible] station in Puerto Ordaz.
(3) Improve quality control and [illegible] evaluation of [illegible] station.
(4) Assure effectiveness of the [illegible] station, if [illegible] and, if indicated, change in the design station or [illegible].
(5) If a station change is [illegible] make an effort, [illegible] the [illegible] and change to a new [illegible], VILLY [illegible], in August.

In discussions with the individual AMS Bureaus, Scientists and Project leaders or Puerto Cortezgo, I was impressed with their technical [illegible] their enthusiasm for research opportunities, and the overall quality of their work under adverse conditions. Research at Puerto Cortezgo is not only particularly conducive to the [illegible] in the region [illegible] for [illegible], but also includes very fundamental components which have long-term applications (such as extreme population pressure).

Observations:

(a) As the eradication program initially undertakes the barrier zone in the lagoon of Tehuantepec, co-partner of central America and the Caribbean will exert pressure to establish a [illegible] zone of the Pacific-Gulfport [illegible]. AMS should begin in coordinate the feasibility of establishing a satellite laboratory, perhaps in Costa Rica, in order to generate necessary research in advance of eradication in new areas. Two [illegible] field research in [illegible] are limited in degree to the Puerto Vallarta. [illegible] operation, AMS should [illegible] America to establish a research capability during 1968, [illegible] the [illegible] of [illegible] budget and personnel ceilings.

(b) ARS line and staff officials are well aware of the problems associated with repatriation of scientists when their obligations in Mexico are completed. Immediate attention is being given to the case of Dr. R. D. Peterson and longer-term consideration should be given to Dr. R. J. Brenner whose obligation terminates in September 1984. In addition, there is a possibility that Dr. O. H. Graham, Project Leader, will retire shortly after the barrier zone is established in December 1984. Considering the normal delays experienced in transferring scientists to Mexico, it is none too soon to begin a search for a new Project Leader at Tuxtla Gutierrez.

Ralph A. Bram

RALPH A. BRAM
National Program Leader
Insects Affecting Man & Animals
and Parasitology

cc:
T. B. Kinney
T. J. Army
R. F. Barnes
J. R. Johnston
O. H. Graham

United States Department of Agriculture
Agricultural Research Service
National Program Staff
Beltsville, Maryland 20705

December 19, 1983

Dr. O. H. Graham
USDA, ARS
Screwworm Research
Apartado 544
Tuxtla Gutierrez
Chiapas, MEXICO

Dear Hugh:

Thank you for agreeing to serve as convenor and moderator of a Screwworm symposium at the 1984 ESA meeting in San Antonio. Please prepare a symposium proposal, including outline, of not more than 4 hours duration and submit this to me before April 15, 1984. There is a possibility that Section D could partially defray the expenses of a Mexican official to participate in the symposium, but please make no commitments until all Section D symposia are approved. I would think that APHIS would provide travel and per diem for their own program officials to participate--for those who are not entomologists, we could provide complimentary registration.

I appreciate your willingness to accept this assignment and feel, as you do, that the San Antonio meeting is a most appropriate forum to showcase the success of screwworm eradication by the sterile insect technique.

Best personal regards and Season's Greetings.

Sincerely,

RALPH A. BRAM
National Program Leader
Insects Affecting Man & Animals
and Parasitology

cc:
O. H. Graham (home address)

United States Department of Agriculture
Agricultural Research Service
Southern Region
Southern Plains Area
Screwworm Research
Apartado Postal #544
Tuxtla Gutierrez, Chiapas
Mexico

December 28, 1983

TO: Management Personnel in Methods Development and Production

Enclosed is a summary of my reasons for suggesting that the possible contamination of O-83 within production flies, and other incidences of past or future contamination of 10 or less flies entering populations of 100's of thousands or millions, is not likely to have effect on the performance of a new strain.

I mentioned this during our 8 Dec. meeting. I would like to submit this document for the weekly report. I will also revise this slightly and submit a manuscript with citations etc. to the APHIS publication series.

ROBERT L. MANGAN
Research Entomologist

In recent technical meetings, the topic of possible contamination of new strains with genetic material from the old and better plant adapted strain has been discussed. This genetic contamination was mentioned during the V-81 - A-82 change over when A-82 suddenly lost larval size, and in December 1983 due to the poor isolating barrier between O-83 flies in Methods and Development and the main production areas.

The purpose of this note is to outline, with some degree of scientific formality, the probabilities of significant change in the genetic structure of the strain in Methods due to contamination. The formulas and mathematical models used here were developed by J. B. S. Haldane and R. A. Fisher in the 1920's and 1930's, by S. Wright for the 1930's to the present and by M. Kimura in the 1950's and 1960's. The major questions these population geneticists and statisticians addressed are: What is the probability that a new advantageous or detrimental gene will ultimately survive in a population? and; How many generations will be required for this new gene to increase to a certain frequency if it has a known selective advantage?

This body of theoretical work is largely not realistic for natural populations for a number of reasons. The reproductive structure (mating patterns, number of off spring etc.) age structure, (immature, reproductive and scenescent, etc.) and ecological factors affecting rates of selection and population fluctuations are seldom known with adequate precision to make any calculations reliable. The values for calculating probabilities and rates of genetic changes are, however, frequently available for domestic animals, crop plants and some human populations. Agricultural and medical geneticists have relied fairly heavily on this body of theory.

In recent terrestrial ecology, the topic of possible contamination or non-existence with possibly material from the old and better place adapted within has been discussed. This cosmic contamination are concluded during the 1960's - 1980's change over when 1980 suddenly lost larval also, and in October 1983 due to the poor isolating barrier between G-83 tides in Mathada and Cavulcanar and the main production areas.

The purpose of this note is to outline, with some degree of scientific formality, the possibilities of significant change in the genetic structure of the virgin in Mathada due to contamination. The formulae and estimation models used here were developed by J. B. S. Haldane and R. A. Fisher in the 1920's and 1930's, by P. Wright for the 1940's to the present and by M. Kimura in the 1960's and 1970's. The major questions these population models and estimations addressed are: What is the probability that a new characteristic or hereditary gene will ultimately survive in a population? Over how many generations will be required for this new gene to increase to a certain frequency if it has a known selective advantage?

This body of theoretical work is largely not realistic for natural populations for a number of reasons. The reproductive advantage varying patterns, mutation, differing sex and age structure, immigrant, reproductive and loss genes, social and cultural factors, selective rates of mutation and population fluctuations are seldom known with adequate precision to make and calculations even realistic. The values for calculating probabilities and rates or genetic changes are, however, readily available for domestic animals, crop plants and some human populations. Statistical and mathematical models have relied heavily heavily on this body of theory.

Data used in calculations:

Adult population size (per week)

| | |
|---|---|
| Number of cages with adults | 42 |
| Number of liters pupae/cage | 6 |
| Number of pupae/liter | 10183 |
| Ne = Effective number of adults | 2,566,116 |

| | |
|---|---|
| Total population-size liters pupae produced per day | 300 |
| liters pupae produced per week | 2100 liters |
| N = Total weekly population pupae | 21,384,300 |

Gene frequencies of contaminants.

1 unmated female enters adult population

or $p = \frac{1}{2566116}$

1 male enters adult population and mates once = .0000004

1 mated female enters adult population

or $p = \frac{2}{2566116}$

1 male enters adult population and mates twice = .0000008

In general, the frequency of contaminants genes = $\frac{nc}{Ne}$

= The number of times contaminants are represented/effective population size.

Calculation of 'Fate' of Contaminant Genes

I. What is the ultimate probability that a contaminant gene with a selective advantage (=s) will survive in the population?

R. A. Fisher and S. Wright have shown that if Ne = N, then the ultimate survival probability is 2s, that is twice the selective advantage. For this data Ne = .12 N, the corrected formula, then, is

$$u = 2s\left[\frac{Ne}{N}\right]$$

the lower limit of values for s in order for the contaminant gene to have a significant ( >5%) chance of even surviving in the Methods strain require that this gene would have to have approximately a 25% advantage in the heterozygotes condition. This I would estimate is 10 higher than any reasonable estimate of selective advantage. A series of probabilities of survival for different s values are given in Table 1.

If the gene is advantageous but recessive, a condition which I think is more likely (see Note 1), the probability of ultimate survival is:

$$u = \sqrt{\frac{2s}{\pi}}\,Ne$$

In this case only homozygous contaminants have a selective advantage and, again for s = .25 and Ne = 2,566,116

$$u = \sqrt{\frac{2\ (.25)}{\pi(2,566,116)}} = .00025$$

Kimura has calculated intermediate probabilities and has shown that for low degrees of expression of a contaminant in heterozygotes a 10x increase in expression results in approximate doubling of probability of survival.

Calculation of "Pure" of Gametogenic Genes

X. What is the ultimate probability that a gametogenic gene with a selective advantage (s>0) will survive in the population?

R. A. Fisher and S. Wright have shown that if $s_a = s_A$ then the ultimate survival probability is $2s$; that is, twice the selective advantage. For this case $Nu = .1N$, the corrected formula, then, is

$$u = 2s\left[\frac{Nu}{N}\right]$$

The lower limit of values for s in order for the gametogenic gene to have a significant (.05) chance of ever surviving in the Drosophila strain requires that this gene would have an have approximately a 25% advantage in the heterozygotes condition. This I would indicate is 10 higher than any reasonable estimate of selected advantage. A series of probabilities of survival for different s values are given in table 1.

If the gene is advantageous but recessive, a condition which I think is more likely (see note 1), the probability of ultimate survival is

$$u = \sqrt{\frac{2s}{\pi\, Ns}}$$

In this case only homozygous gametogenic have a selective advantage and, again for $s = .25$ and $Ns = 1,500,000$

$$u = \sqrt{\frac{2\,(.25)}{\pi\,(2,500,000)}} = .00025$$

There has calculated intermediate probabilities and the above line for the degree of expression of a gametogenic in heterozygotes. A 10% increase in expression results in approximate doubling of probability of survival.

In summary, the ultimate probability that a migrant contaminant in the Methods population will survive is extremely small (less than 1 in 100 ) if the selective advantage of this gene is within the expected normal range (1 to 5% advantage). If the gene is recessive the probability is much smaller (less than 1 in 1000) no matter what the selective advantage is. In order to have a statistical probability of survival, contaminant genes must have high expression in heterozygotes and greater than 25% selective advantage over the methods population.

II. Assuming that the migrant contaminant survives (or is repeatedly introduced) now long will it take for the contaminant gene to spread through the population?

With no dominance of contaminant or strain genes, the proper formula for calculation of number of generations is

$$t = \frac{2}{s} \ln \left[ \frac{P_t \ (1-P_o)}{P_o \ (1-P_t)} \right]$$

With t = number of generations, s = selective advantage, $P_t$ = frequency of contaminant at generation t, and $P_o$ = initial contaminant frequency. This formula is only strictly accurate for lower selection values but assuming slight error for large values the number of generations can be calculated.

The initial frequency ($P_o$) is assumed to be n/Ne = n/2,566,116 for n contaminant flies. Table 2 gives the number generations and number of years necessary for the frequency of contaminants to reach .10 and .15 for 3 and 10 contaminants per 7 day period. Three adult contaminants would equal 3 unmated females, or 1 mated female and 1 male that mates once, or 1 male that mates 3 times, etc.

To summary, the ultimate probability that a mutant concentrant in the mutant population will survive is extremely small (less than 1 in 100 ) in the selectively advantageous of this case in within the expected normal range (1 to 5% advantage). If the gene is recessive the probability is much smaller (less than 1 in 1000) no matter what the selective advantage is. In order to have a statistical probability of survival, concentrant genes must have high recessivity in heterozygotes and greater than 5% selective advantage over the resident population.

It assuming that the mutant concentrant survives (or is repeatedly introduced) how long will it take for the concentrant gene to spread through the population?

With no dominance of concentrant or stable genes, the proper formula for calculation of number of generations is

$$t = \frac{1}{s} \log_e \left[ \frac{p_0 (1-p_t)}{p_t (1-p_0)} \right]$$

With t = number of generations, s = selective advantage, $p_t$ = frequency of concentrant at generation t, and $p_0$ = initial concentrant frequency. This formula is only slightly accurate for lower selective values but assuming higher error for large values the number of generations can be calculated.

The initial frequency ($p_0$) is assumed to be $1/2N$ = $n/2.5e6,1/N$ for a concentrant allele. Table 2 gives the number generations and number of years necessary for the frequency of concentrants to reach .10 and .10 for 5 and 10 concentrants per 2 day period. Three adult concentrants would equal 5 mutated genes, or 1 mated female and 1 male that mutes once, or 1 male that mutes 2 times, etc.

If a gene frequency of 10% contaminants would be required in order to detect the contamination effects, even at a selective advantage of 30%, 83.6 generations would be required to detect contamination if 3 adult equivalents entered a colony cage. More than triple the contamination rate to 10 adult equivalents reduces the time to 68.4 generations, giving less than 20% reduction in time (see Note 2).

## Conclusions

The calculations I have presented here are based on fairly reliable information provided by the personnel in Methods and Development. An important question is how errors in these measurements may might affect the probability and time necessary for contaminants to be effective. One possibility of error is in Ne, the number of adults in the colony. If the number of cages were 36 rather than 42, about 14% less adults would be present. If production remained at 21.4 million, Ne/N would be reduced to .10 resulting in a negligible probability reduction. The probability of survival of a contaminant with .10 advantage would then be .020 rather than .024. The time necessary to reach a significant frequency would be reduced in a similar manner.

A final note should be made concerning other types of contamination. At present isolation of Methods colonies from the plant is not adequate. As strains are collected from areas more central to screwworm populations, the prevalence of fungal, bacterial and viral deseases is expected to increase. A well known dogma of biogeography is that parasitic diversity increases toward the center of the range of a species. Without attempting to sound like a doomsday predictor, I think that the possibility of a diseased or parasitized strain entering the plant is a very likely consequence of poor isolation between the Methods section and production. An outbreak of a

If a virus frequency of 10% contaminants would be required in order to detect the contamination effects, even at a selective advantage of 30%, 23.6 generations would be required to detect contamination if 4 adult equivalents entered a colony cage. More than triple the contamination rate to 10 adult equivalents reduces the time to 6.4 generations, giving less than 20% reduction in time (see Map 3).

## Conclusions

The calculations I have presented here are based on fairly reliable information provided by the personnel in Nairobi and Ceneiphoron. An important question is how sensitive in these assumptions may might affect the probability and time necessary for contaminants to be effective. One possibility of error is in my, the reader's, guess in the colony. If the number of cages were 20 rather than 40, about 1/3 less adults would be present. If population remained at 5.4 million, MAD would be reduced to .10 resulting in a negligible probability reduction. The probability of mixed of 2 contaminant with .10 advantage would then be .000 rather than .027. The time necessary to reach a significant frequency would be reduced in a similar manner.

A final note should be made concerning other types of contamination. Air borne isolation of Nairobi mutants from the plant is not adequate. Mutations are sometimes then also used to increase productivity, the presence of fungal, bacterial and viral diseases is suspected to increase. A well known case of mutagenicity is that particle discovery increasing toward the center of the range of a transmitter. Without attempting to model this a necessary prediction, I think that the possibility of a diseased or parasitized strain entering the plant is a very likely consideration of poor isolation between the testicle seedlen and protoxylem. An incidence of a

wasp parasite such Nasonia vitripennis which periodically infests the Fargo, N. D. laboratory would make our housefly problem appear as nothing.

All the calculation above used Ne as the number of adults in the colony at full production. During the two to three generation period of expansion, when a new strain is first turned over to Methods, contamination may have more serious consequences. A contaminant entering a population of 10,000 flies could, with a selective advantage of s = .30, increase to a frequency of .50 in only 61.40 generations (= 3.5 years). While this is still much shorter than the time to test and use a strain, these calculations do show that the smaller the colony population, the more serious the consequences of contamination.

many parasite such Masonia vitripennis which periodically infests the farm. U. S. laboratory would make our housefly problem appear as nothing.

All the calculation above need be as the matter of habit in the colony at full production. During the two to three generation period of expansion, when a new strain is first turned out to breeding, another strain may have more serious consequences. A constant substrain a population of 10,000 flies would, with a relative advantage of 1 = .30, increase to a frequency of .90 in only 40-40 generations (= 4.5 years). Fully this is still much shorter than the time it took and use a strain. These calculations to show that the realize the actual population, the more serious the consequences of contamination.

Table 1.

Probability of ultimate survival of migratory contaminant genes entering the Methods Development population with positive selective advantage, a large Methods population, and Ne = .12N

| | | | | | |
|---|---|---|---|---|---|
| Heterozygote Selective Advantage | .01 | .05 | .10 | .25 | .30 |
| Prob. of Survival | .0024 | .012 | .024 | .060 | .072 |

Table 2.

Number of generations required to change gene frequency of mutant contaminant from $P_o$ (= number of contaminants/total adult population) to $P_t$ (= 10% and 15%) for varying selective coefficients(s) and varying number of contaminants.

A. For 3 adult contaminants per 7 days

| To final frequency of: | Selective coefficient(s) .01 | .03 | .07 | .1 | .3 | |
|---|---|---|---|---|---|---|
| .10 | 2506.9 | 835.6 | 358.1 | 250.7 | 83.6 | generations |
| | 144.2 | 48.1 | 20.6 | 14.4 | 4.8 | years |
| .15 | 2599.4 | 866.5 | 371.3 | 259.9 | 86.6 | generations |
| | 149.5 | 49.9 | 21.4 | 15.0 | 5.0 | years |

B. For 10 adult contaminants per 7 days

| To final frequency of: | Selective coefficient(s) .01 | .03 | .07 | .10 | .30 | |
|---|---|---|---|---|---|---|
| .10 | 2051.6 | 683.9 | 293.1 | 205.2 | 68.4 | generations |
| | 118.0 | 39.3 | 16.9 | 11.8 | 3.93 | years |
| .15 | 2144.1 | 714.7 | 306.3 | 214.4 | 71.5 | generations |
| | 123.4 | 41.1 | 17.6 | 12.3 | 4.1 | years |

Table 3.

Number of generations required to change gene frequency of mutant contaminant from $E_0$ (a number of contaminants/total adult population) to $E_1$ (a 10% and 15%) for varying selective coefficients(s) and varying number of contaminants.

A. For 3 adult contaminants per 7 days

Selective coefficients(s)

| To final frequency of: | .01 | .02 | .05 | .1 | .3 |
|---|---|---|---|---|---|
| .10 | 4506.8 | 1125.5 | 359.1 | 250.7 | 85.6 generations |
| | 144.2 | 40.2 | 20.6 | 14.4 | 4.6 years |
| .15 | 2899.4 | 666.3 | 171.3 | 120.3 | 38.6 generations |
| | 149.8 | 40.9 | 21.4 | 15.0 | 5.0 years |

B. For 10 adult contaminants per 7 days

Selective coefficient(s)

| To final frequency of: | .01 | .02 | .05 | .10 | .30 |
|---|---|---|---|---|---|
| .10 | 4021.2 | 1083.8 | 293.1 | 202.2 | 66.4 generations |
| | 138.0 | 38.3 | 18.9 | 14.3 | 3.92 years |
| .15 | 2543.1 | 718.7 | 189.1 | 124.4 | 71.2 generations |
| | 133.4 | 41.1 | 17.0 | 12.3 | 4.1 years |

Note 1. Here I give reasons for assuming genes for plant adaptation which include traits such as small size and faster development as well as the possibility of poor performance in the field are recessive. Two strains in recent times have apparently been "bad" genetically, based on poor performance in the field and great program improvement when they were replaced. The observation was given by Mr. Sudlow and Dr. Meadows as well as others who have experienced strain deterioration that "when strains start to go bad, they go quickly". Recessive genes are selected more quickly as their frequency increases since the probability of an individual being homozygous for the recessive and enjoying this advantage increases. Dominant genes are selected for quickly at first then much more slowly. For example, time to change an expressed dominant character (phenotype) frequency from .01 to .50, with selection of 10% favoring a dominant gene in a large population, is 48.2 generations. To change from .50 to .99 frequency of the same gene with the same selection would require 116.6 generations. The same selection acting on phenotype frequency of recessive genes requires 116.6 generation to move from .01 to .50 and 48.2 generations to move from .50 to .99. Thus observed changes in performance of populations in the plant seem to fit a recessive mode of in heritance.

Here I give reasons for assuming genes for plant adaptation within include traits such as small size and faster development as well as the possibility of poor performance in the field are necessary. The strains in recent times have apparently been "bad" generally, based on poor performance in the field and great problem improvement when they were replaced. The observation was given by Mr. Sudlow and Dr. Mathews as well as others who have experienced strain deterioration that "when strains start to go bad, they go quickly". Inadaptive genes are selected more quickly as their frequency increases since the probability of an individual being homozygous for the recessive and enjoying this advantage increases. Dominant genes are selected for quickly at first then much more slowly. For example, this is change as expressed dominance character (phenotypic) frequency from .01 to .99, with selection of 10% favoring a dominant gene in a large population, in 69.2 generations. To change from .50 to .99 frequency of the same gene with the same selection would require 116.6 generations. The plant selection setting up phenotype (frequency of recessive genes) requires 187.6 generations to move from .01 to .50 and 69.2 generations to move from .50 to .99. Thus observed changes in frequencies of populations in the plant cause to fix a recessive mode of in heritance.

Note 2. A question which should be raised here is: How do strains go bad given that contaminants (and mutants) will have such low survival probability and will take so long to become established? Two factors are important in this consideration. First, even under the best conditions on hydroponic diet and usually on meat diets, laboratory screwworms are about 70% as large as wild screwworms. Second, genes for early crawl off and small size, in order to survive when media is bad, are probably adaptive for a parasite such as the screwworm which frequently kills its host. I feel that genes for laboratory or plant adaptation are present at relatively high frequency in wild populations. Rearing these flies under stress probably selects <u>against</u> genes which keep these traits from being expressed except under stress while, at the same time, increasing the frequency of these traits. At present in our laboratory we are investigating the modes of inheritance of laboratory adaptation. I feel quite confident in believing at present that plant adaptation and loss of performance in the field is due to selection for expression of traits which are already present. This selection, at present, is an inevitable result of rearing screwworms on media other than live animals.

Note 2. A question which should be raised here is: How do strains go bad given that contaminants (and mutants) will have such low survival probability and will take so long to become established? The factors are important in this consideration. First, even under the best conditions on hydrogenic diet and usually on meat diets, laboratory microwaves are almost 70% as large as wild microwaves. Second, given the early crowd out and small size, in order to survive when media is bad, are probably adaptive for a strain such as the microwave which frequently kills its host. I feel that genes for laboratory or plant adaptations are present at relatively high frequency in wild populations. Testing these first under stress probably selects against genes which keep these traits from being expressed except under stress which, at the same time, increases the frequency of these traits. At present in our laboratory we are investigating the modes of inheritance of laboratory adaptation. I feel quite confident in believing at present that plant adaptation and loss of pathogenicity in the field is due to selection for expression of traits which are already present. This selection, at present, is an inevitable result of testing microwaves on media other than live animals.